Esthetic restoration of maxillary incisors using CAD/CAM chairside technology—A case report

Bodo Seydler, DDS1/Marc Schmitter, DDS, PhD1

High-quality esthetic veneers can be produced in a single treatment session only by means of chairside CAD/CAM technology. With efficient therapy, the duration of the relatively long treatment cycle can be optimized: planning casts and a diagnostic wax-up are steps that simplify therapy decisions, the same as with veneers produced by laboratories. After production of a mock-up and preparation of the teeth, removable composite veneers can be prepared and gradually replaced by ceramic veneers. Modern, three-dimensional presentation by use of the Cerec 3D system facilitates construction of veneers seen in relation to the other teeth. A very helpful aspect is that the mock-ups can be adjusted to patients’ needs during the complete production process. After individualization by a dental ceramic technician, there is no recognizable esthetic difference from veneers produced by a laboratory. (Quintessence Int 2011;42:533–537)

Key words: CAD/CAM, chairside technology, veneering

All-ceramic restorations have been produced with computer-aided design/computer-assisted manufacturing (CAD/CAM) technology for many years, although chairside production is also possible. Within only one therapy appointment, defective amalgam fillings can be replaced and decayed teeth can receive crowns. For posterior teeth, it is easy to fulfill the functional and esthetic demands of the patient. In the much more (esthetically) challenging anterior region, the esthetic requirements of all-ceramic restorations are much greater.

Extensive changes of tooth shade or shape are normally achieved by use of veneers or crowns, which are produced by a laboratory after taking an impression. The quality of chairside CAD/CAM-produced restorations must therefore compete with the results produced by laboratories.

Extensive preparatory work (for example, cast analyses, wax-ups, or mock-ups) is the basis of each treatment. This is necessary for appropriate preparation of the teeth by the dentist. In the laboratory, this preparatory work helps the dental technician to find the perfect tooth shape. Production based on dental casts is the deciding difference compared with chairside computer-assisted designs. Using this technique, defined changes must be implemented in an abstract environment. This is a disadvantage balanced by regular fitting of the restoration to monitor the production process.

The permanent availability of the patient during the chairside production process is of great benefit in this context. Other important advantages for the patient are results after only one treatment session and avoidance of a provisional restoration.

The objective of this case report is to determine whether esthetic aspects of chairside-produced veneers are comparable with those of veneers produced in a dental laboratory.

CASE REPORT

A 42-year-old woman wanted esthetic treatment of her teeth. She was bothered by partially nonveneered, unsatisfactory crowns and partial dentures. In the anterior region, she was dissatisfied with tooth discoloration and irregular tooth shade and shape.
Fig 1  Initial intraoral view.

Fig 2  Initial extraoral view. Note the disharmonic smile line.

Fig 3  Flowchart of the treatment procedure.

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Her teeth were barely visible when smiling because of a negative smile line (Fig 2). Clinical and radiologic analyses revealed a prosthetically preserved situation with a neutral bite and canine guidance. Dental hygiene was very good; there was no periodontal damage resulting from previous treatment.

Planning casts were produced and used to check whether treatment without endodontic therapy was possible. A wax-up was also produced. The restored posterior teeth were to be replaced by new crowns and partial dentures. Treatment of the anterior region with composites was not considered because of severe discoloration and great extent of the tooth-shape correction required. Shaping of composite structures in a patient’s mouth is very labor-intensive. Also, permanent color stability cannot be guaranteed\(^1\) and abrasion is greater than that for ceramics.\(^2\)

For these reasons, veneers were recommended. The patient wanted very bright, normal teeth. It was planned that all teeth in the visible region would be A1 (Vitapan Classical, Vita). No other individualization that would have affected the color of the veneers was envisaged. Planned modifications of tooth shape in the maxilla were enlargement and shape optimization. For the mandible, the focus was on optimization of tooth position.

For the maxilla, chairside production of the veneers was proposed to the patient. The patient welcomed this treatment. To compare results with traditionally produced crowns, the veneers in the mandible were produced by a laboratory after an impression had been taken.

A detailed description of the dental treatment will focus on the CAD/CAM production of veneers in the maxilla. The flow chart in Fig 3 shows the steps of the process on the day of treatment. Initially, the anterior teeth were built up with synthetic material (Tetric, Ivoclar Vivadent) in accordance with the wax-up (Fig 4). CAD/CAM production without a cast requires permanent monitoring of the veneer during construction, always in relation to the other teeth. The intention was to replace composite veneered teeth with blank veneers. Achieving (perfect) symmetry of the veneers is very labor-intensive, so effort is necessary to reduce treatment time. In the first step, the mock-up was molded with silicone (Silikon Knetmasse, Omnident). The teeth were anesthetized (Septanest, Septodont) and prepared (Fig 5). Because of the substantial shade difference, a large layer of the tooth structure had to be removed, despite the planned tooth enlargement. The amount of reduction of the tooth material was checked by use of a silicone key (Silikon Mass, Omnident). An alginate impression (Alginat Rose, Omnident) was taken, and the mock-up was replicated with composite material used for provisional restorations (Protemp, 3M ESPE) and the silicone impression. The separated provisional veneers were then removed one after the other, the prepared teeth were scanned (Cerec AC, Sirona Dental Systems), and the veneers were constructed and milled (Cerec AC, Cercon MC XL, Sirona Dental Systems) (Figs 6 and 7). To optimize symmetry, we...
started the preparations with the maxillary right canine, followed by the lateral incisors and finally the central incisors.

Individualization was performed by a dental technician. The edges were again harmonized and blank veneers were appropriately colored and glazed (IPS Empress Universal Glazing Paste, IPS Empress Universal Stain/Shade, Ivoclar Vivadent).

The expected result was presented to the patient by means of Variolink II Try-In (Ivoclar Vivadent). After repeat anesthesia, the veneers were conditioned, silanized (Vita Ceramics Etch, Vita; Monobond S, Ivoclar Vivadent), and adhesively luted (Total Etch, Syntac Primer, Syntac Adhesiv, Heliobond, Variolink II A1, Ivoclar Vivadent; Fig 8).

Figure 9 shows the result of esthetic correction after production of the veneers in the mandible. There is no visible difference between the veneers in the mandible, produced by a laboratory and those in the maxilla, produced by CAD/CAM (Fig 10).

**DISCUSSION**

Data regarding ceramic veneer usage for the restoration of anterior teeth has been gathered for over 30 years. The literature indicates that ceramic veneers are a reliable solution. Veneers are available in a variety of materials and can be produced via a multitude of methods. Patient satisfaction is striking.\(^3\)\(^\text{a}\) Failure of ceramic veneers is less than 5% after 5 years and even less than 10% after 10 years.\(^5\)

Veneers are most often produced in a laboratory after impressions are taken. The Cerec system enables chairside production in only one treatment session. A work-intensive and, with regard to veneers, difficult-to-produce and fixed provisional solution is no longer necessary, and the risk of damaging the prepared teeth while using a provisional solution is eliminated. The optimum quality of the tooth surface is, furthermore, preserved for adhesive cementation.\(^6\) Survival
of Cerec veneers is 94%. The chances of success are, therefore, almost as high as those with conventional veneers; 98.8% of patients describe their CAD/CAM-produced solution as successful.7

In our experience, treatment of a patient with several Cerec veneers requires a relatively long treatment time. A substantial amount of time can be saved by rational aggregation of the treatment steps or by arranging multiple treatments. One publication8 indicates a time requirement of between 1.5 and 2.5 hours per Cerec veneer. This conforms with our experience. Work-intensive and successful veneer solutions by use of Cerec 3 have already been described. The milling process and designing the veneers were the most time-intensive procedures.9

Cerec’s 3D graphic presentation enables extremely precise and accurate design of veneer size and shape. In conjunction with a mock-up, even complex corrections can be realized efficiently by gradually replacing the composite structures.

The final, but most essential, element of the esthetic design is the fine-tuning of the shape and shade by a clinician who is experienced in the individualization of ceramics. The high demands of a patient can be fulfilled only when there is no visible difference between solutions produced by a laboratory and those produced by use of the chairside technique (see Fig 8).

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REFERENCES